

determination to act upon them, Roy, as a pathologist, had the firm belief that the future science of pathology was most surely and most quickly to be reached along the same lines of advance as physiology has followed with signal success, especially since Ludwig and Bernard. The inferences to be drawn from the mere anatomical study of structural changes induced by morbid processes he considered to be practically exhausted. Indeed, he thought much time had been wasted in pushing such observations into confines of hair-splitting minuteness and detail. It would be, however, wrong to suppose he took little interest in microscopy. On the contrary, new methods of staining tissues, and colouring bacteria, and of following appearances of phagocytosis appealed to him strongly and immediately, and he was early to follow them. It was rather that the laborious unravelling of an individual autopsy by prolonged histological search and anatomical induction seemed to him unfruitful labour, and he gave little time to it. He turned to physical and, especially, to mechanical methods. His ingenuity in devising and his manual skill in the using of mechanical apparatus was, as Kuhne wrote, quite "extraordinary." Indeed, it was to a certain extent harmful to the quality of his work. It limited the scope with which he undertook and the depth to which he pursued a subject. It continually tempted him to wander from investigations toward which he had already accomplished the preliminaries, to open fresh ground in some other direction. A plan usual with him in his own work was to set before himself the obtaining of some particular measurement, *e.g.* the volume of an organ under certain conditions; the more difficult the experiment, the more attraction had it for him; he devised appropriate apparatus, tried it, altered it, made it successful, obtained a certain number of complete experiments, and then moved to another problem often not cognate with that previously taken up. The accuracy and rapidity with which he dissected were surprising, and for dexterity as an operator in the laboratory he had no rival in this country. His scientific papers were all written in a brief, simple and direct style, without repetition of statement, and usually without even any final recapitulation. Protocols of experiments were almost always excluded from them.

As a teacher his career commenced with his advent to Cambridge. His lectures were marked by striking and suggestive thoughts. The matter of them suffered somewhat from the rapid manner of their delivery. He cherished an intention to publish a volume of lectures on the pathology of the circulation; many of his lectures on this subject were brilliantly original. He did not illustrate his lectures by any experiments performed in the lecture hour. In the ordinary students who attended his classes simply for examination purposes he took curiously little interest; whether they passed or failed, attended or did not attend, seemed to go unnoted by him. To those who came to him to pursue research, even of the most unambitious kind, he was a different man. These he treated almost at once as personal friends, and he attached them to him by many ties of kindness and respect. In regard to their work, he was always absolutely sympathetic, equally so in failure and in success. In facing difficulties with them in the experiments they might have in hand, he encouraged with an undaunted cheerfulness of manner, and gave time and thought completely unstintingly in their companionship. He had been heard to confess an ambition to create a school of work in his laboratory somewhat on the lines of that formed in Ludwig's laboratory at Leipzig. Had his original strength been maintained, the results that his life had already produced are earnest, we think, that his ambition would not have been unfulfilled. As it is, his contributions to the study of the mechanisms concerned with the circulation of the blood

can of themselves assure to him a lasting place in the esteem of all biologists.

Prof. Roy was buried at Cambridge on Friday, the 9th inst. The first portion of the burial service was held in the chapel of Trinity College, and was attended by many office-bearers of the University and other members of the Senate. The chief mourners were Mr. James Roy, of Arbroath (brother), Mr. Edmund Paget, Mr. Meyrick Paget, Dr. and Mrs. Hans Gadow, Prof. J. J. Thomson, Prof. Sherrington, Prof. Kanthack, Dr. Lazarus-Barlow, Mr. Cobbett, Mr. Graham Kerr, and Miss Kingsley (niece of the late Charles Kingsley). The clergy officiating in the chapel were the Master of Trinity (Dr. H. Montagu Butler), the Senior Dean (Rev. A. H. F. Boughey), and the Rev. L. Borissow (Precentor). The interment took place at the Mill Road Cemetery, where the Rev. Dr. Thomson, of Oxford, officiated. The proceedings at Trinity were attended by the Vice-Chancellor (Dr. Hill), the Master of Sidney, the Master of Christ's, the President of Queens', Prof. Allbutt, Prof. Macalister, Prof. Bradbury, Prof. Forsyth, Prof. Newton, Prof. Cowell, Prof. Mayor, Prof. Ewing, Prof. Stanton, Dr. Gaskell, Dr. L. Humphry, Dr. Jackson, Dr. Ruhemann, Dr. William Hunter, Dr. Griffith, Dr. Cunningham, Dr. Langley, and Dr. Postgate.

NOTES.

AT the annual general meeting of the London Mathematical Society, which will be held on November 11, the following names will be proposed for election on the Council of the ensuing session :—President, Prof. Elliott, F.R.S.; Vice-Presidents, Major MacMahon, R.A., F.R.S., Dr. Hobson, F.R.S.; Treasurer, Dr. J. Larmor, F.R.S.; Hon. Secretaries, R. Tucker, A. E. H. Love, F.R.S. Other members: Lieut.-Colonel Cunningham, R.E., Dr. Glaisher, F.R.S., Prof. Hill, F.R.S., Prof. Hudson, M. Jenkins, A. B. Kempe, F.R.S., F. S. MacAnlay, D. B. Mair, G. B. Mathews, F.R.S., W. D. Niven, C.B., F.R.S.

SIR PETER LE PAGE RENOUF, the eminent Egyptologist, and for several years keeper of the Egyptian and Assyrian antiquities at the British Museum, died last week, at the age of seventy five.

DR. VICTOR HORSLEY, F.R.S., has been returned at the head of the poll in the recent election for a direct representative on the General Medical Council.

THE Queen has conferred upon Dr. H. Hicks, F.R.S., president of the Geological Society, the Jubilee medal in commemoration of the sixtieth anniversary of her Majesty's reign.

REUTER'S Agency reports that the Imperial Russian Geographical Society is fitting out an expedition to Abyssinia for the purposes of anthropological research. The expedition, which will be under the leadership of M. Dmitrieff, will start during the present autumn.

THE death is announced of Mr. James Heywood, who took an active part in the movement for the abolition of theological tests at universities. Mr. Heywood was elected a Fellow of the Royal Society as long ago as 1839; he was also a Fellow of the Geological Society, and published several works on geological subjects.

WE regret to announce the deaths of Mr. William Scott, Director of the Royal Gardens and Forests, Mauritius; Dr. F. W. Barry, senior medical inspector to the Local Government Board; Dr. Hjalmar Heiberg, professor of pathological anatomy in the University of Christiania; Dr. Hermann

Welcker, sometime professor of anatomy in the University of Halle, and a distinguished anthropologist; Dr. R. Branchat, professor of hygiene in the Medical Faculty of Granada; Dr. Leopold Auerbach, assistant professor of physiology in the University of Breslau; Mr. Percy Lund Simmonds, the author of numerous works on various branches of technology.

THE International Leprosy Conference was opened at the Imperial Board of Health, Berlin, on October 11. Prof. Virchow was elected President of the Conference, and on his proposal Prof. Lassar (Berlin) and Dr. A. Hansen (Bergen) were elected Vice-Presidents, and Dr. Ehlers (Copenhagen) Secretary-in-Chief. The Conference has appointed a commission composed of twenty members, with power to add to its number, to confer and prepare the way for an International Leprosy Society.

PHYSIOLOGICAL chemistry has just lost one of its most diligent and capable workers in the person of Dr. Edmund Drechsel, professor of physiological and pathological chemistry and of pharmacology in the University of Berne. At the time of his sudden death, Dr. Drechsel was at Naples working in the Zoological Station there at some of those problems in the chemistry of the invertebrates which have recently absorbed much of his attention. On September 22 he died suddenly of disease of the heart, at the age of fifty-four. The *British Medical Journal* gives the following particulars of the career of this distinguished exponent of the chemistry of physiology:—Born in Leipzig in 1843, he studied chemistry at the University there with such success, from 1863 onwards, that in 1865 he became assistant to Kolbe, who was then professor of chemistry. He took his Doctor's degree in Philosophy in 1865. In 1872 Ludwig appointed him his assistant in the Chemical Department of the Physiological Institute, where he carried on many researches, and aided Ludwig and his numerous pupils when they required assistance in matters chemical. In 1878 he was elected Extraordinary Professor in the Medical Faculty, and remained at Leipzig under Ludwig until he was called to Berne to fill the chair of Physiological Chemistry there. In 1883 the University of Leipzig conferred upon him the degree of M.D. Much to his regret, Drechsel did not follow a medical career. He entered upon the study of physiology purely from the chemical side, so that his work—always of the highest class and carefully done—dealt rather with problems of a distinctly chemical nature. He was a laborious and painstaking worker, and whatever he did was done thoroughly. Drechsel made many contributions to physiological chemistry, and he was a perfect encyclopædia of knowledge regarding chemical problems.

It is so commonly assumed that poetry and science are antagonistic, that an address delivered by the Poet Laureate, Mr. Alfred Austin, at the opening of a new school of science and art last week, deserves a wide publicity. Macaulay, with his well-known love of antithesis, once endeavoured to show that as civilisation advances, poetry almost necessarily declines; and taking science as one of the most important factors in the civilising process, the inference is that a poet with a knowledge of scientific facts labours under a disadvantage. Now, however, we are able to give a Poet Laureate's opinion that science and art are complementary to one another and not rivals. Science, said Mr. Austin, is exact knowledge—that and nothing more. But exact knowledge is the foundation of all the arts, and no man ever achieved real greatness in any of them who did not have the firmest grasp of the permanent facts which underlie them. Music, the most intangible and fantastic of the arts, cannot move one step, nor excite a single emotion without submitting to the severe discipline of numbers. Finally, the matter of a poet's verse is not of much account unless it be animated by the scientific spirit of close and wide observation

and of loving accuracy. There is thus no means of getting away from exact knowledge or science if one aspires to be an artist. It must be obvious to any one who has read the "*Divina Commedia*" that the greatest poet of the middle ages, than whom there was none greater in any age, was thoroughly familiar with all the science or exact knowledge of his time; and Leonardo da Vinci, who might have equals, but had no superior in the realm of painting, was not more fascinated by artistic conceptions than by what are called scientific problems; and at these he laboured indefatigably. Alike, therefore, by necessity and choice, art exhibits a sympathetic kinship with science. The scientific spirit, far from being hostile to the artistic spirit, is ancillary to it, for, as Dryden said, "Genius is perfected by science." The noblest manifestations of both have always occurred in one and the same epoch. Athens produced Euclid as well as Praxiteles; the vigorous old age of Michael Angelo overlapped the precocious youth of Galileo; and Bacon was the contemporary of Shakespeare. And though the century now drawing to a close has been pre-eminently a scientific century, the locomotive and the telephone will not be more enduring than the verse of Byron and Tennyson, or than the pictures of Turner and Watts. The reasoning intellect is the foundation alike of science and of art; but, concluded Mr. Austin, while reason alone suffices to science, art is reason transfigured by emotion.

THE Harveian Oration was delivered before the Royal College of Physicians on Monday by Sir William Roberts, F.R.S., who considered Harvey's life and work, not so much as they concern special studies, but as symbolising the commencement of a new era in human progress—the era of exact science—which, in the present age, is slowly but surely transfiguring the aspects and prospects of civilised society. He remarked that, speaking broadly, the older civilisations rested essentially upon art and literature (including philosophy), while modern civilisation rests, in addition, upon science and all that science brings in its train. A sharp distinction must be drawn between the so-called science of antiquity and the science of to-day. The ancients had a large acquaintance with the phenomena of nature, and were the masters of many inventions. They knew how to extract the common metals from their ores; they made glass; they were skilled agriculturists; they could bake, brew, and make wine, manufacture butter and cheese, spin, weave, and dye cloth; they had marked the motions of the heavenly bodies, and kept accurate record of time and seasons; they used the wheel, pulley, and lever; and knew a good deal of the natural history of plants and animals, and of anatomy and practical medicine. This store of information had been slowly acquired in the course of ages—mostly through haphazard discovery and chance observation—and formed a body of knowledge of inestimable value for the necessities, conveniences, and embellishments of life. But it was not science in the modern sense of the word. None of this knowledge was systematised and interpreted by coordinating principles; nor illuminated by generalisations which might serve as incentives and guides to further acquisitions. Such knowledge had no innate spring of growth; it could only increase, if at all, by casual additions—as a loose heap of stones might increase—and much of it was liable at any time to be swept away into oblivion by the flood of barbaric conquest. It is quite obvious, from the subsequent course of events, that there came into the world of natural knowledge about three centuries ago, in the time of Galileo and Harvey, a something—a movement, an impulse, a spirit—which was distinctly new—which Bacon, with prophetic insight, termed a "new birth of time." This remarkable movement did not originate with any startling revelation; it consisted rather in an altered mental attitude, and a method. There arose a distrust in the dicta of authority, and

an increasing reliance on ascertained facts. These latter came to be regarded as the true and only data upon which natural knowledge could be securely founded and built up. Doubt and question took the place of false certainty. The hidden meaning of phenomena was sought out by observing them under artificially varied conditions—or, to use the words of Harvey, “the secrets of nature were searched out and studied by way of experiment.” *A priori* reasoning from mere assumptions, or from a few loosely observed facts, fell into discredit. Observations were repeated, and made more numerous and more exact. These were linked together with more rigid reasoning to stringent inductions. Hypotheses (or generalisations) were subjected to verification by experiment; and their validity was further tested by their efficacy in interpreting cognate problems and by their power to serve as guides to the acquisition of fresh knowledge. The invention of instruments and appliances for assisting research was an essential and invaluable feature of the “new philosophy.” Physiology and practical medicine have profited immensely by the general advance of the sister sciences, and by the adoption of scientific methods in the prosecution of research. Optical science gave birth to the achromatic microscope. The microscope has laid bare the minute structure of plants and animals, and introduced zoologists and botanists to a vast sub-kingdom of minute forms of life previously undreamt of. The microscope also, in conjunction with chemistry, founded the new science of bacteriology. Bacteriology has inspired the beneficent practice of antiseptic surgery; it has also discovered to us the parasitic nature of zymotic diseases, and opened out a fair prospect of ultimate deliverance from their ravages. Thus have the several sciences advanced, and are still advancing, in concert, step on step, by mutual help, at an ever-increasing speed—pushed on by that irrepressible forward impulse which has characterised the scientific movement from its inception.

MR. ARNOLD PIKE has been cruising this summer in the eastern part of the Spitsbergen archipelago, and, owing to the sea being exceptionally free from ice, was able to make some interesting observations. Stor Fiord was found to be open in the beginning of August, and Mr. Pike's whaler, the *Victoria*, was able to pass northward through Helis Strait, which at the same date last year was closed by fast ice, into Hinlopen Strait. Mr. Pike succeeded in getting as far east along the north coast of North East Land as Charles XII. Island. The ice was there jammed against the shore, and prevented the circumnavigation of North East Land. The *Victoria* then returned down Hinlopen Strait, and steamed eastward to Wich's Land and King Charles' Land. They searched for the islands reported in 1884, by Johannesen and Andreassen, which Captain Robertson earlier this year showed to be non-existent. Mr. Pike adds a reasonable explanation of the source of the error. No old pack ice was seen during the whole voyage, and these exceptional conditions appear to have prevailed throughout the whole of the Greenland and Spitsbergen seas.

THE Meteorological Reporter to the Government of India has just published his annual summary of the *India Weather Review* for 1896, which completes the discussion of the meteorology for that year. In this work the data are presented from two different points of view: (1) for the discussion of the prevalence and spread of disease, and (2) in connection with agricultural questions. For the comparison of medical and meteorological statistics, India is arranged into eleven provinces, the data for each of which are given in a tabular form, while for the second purpose the whole area is divided into fifty-seven meteorological districts. The volume contains a very large amount of useful information, from which we abstract a few general remarks. The mean temperature of the whole of India was normal, or in excess, throughout the year, being more than 2° in April, May

and November. The absolute maximum of the year was 123°, at Jacobabad. The year was the driest on record during the past twenty-two years, the mean humidity being 3 per cent. below the normal; this was chiefly owing to the high temperature, as the mean aqueous vapour pressure was only .01 inch below the average. The rainfall of the year averaged 4.83 inches (or 12 per cent.) below the normal; the deficiency was greatest in Berar (34 per cent.), and in the North-west Provinces and Central India (31 per cent.), and was chiefly due to persistent weakness of the south-west monsoon, and its withdrawal from those parts, from three to seven weeks earlier than usual. The deficiency in 1896 was much more serious than in 1895, and led to the partial failure of the crops over an unusually large area.

AN interesting instance of the effect of geological structure upon local values of magnetic declination is described in the *Journal* of the Franklin Institute (October) by Mr. Benjamin S. Lyman. It appears that about the year 1883 a number of determinations of the compass variation in the counties of Bucks and Montgomery, Pennsylvania, were made, and a chart showing curves of equal declination for every tenth of a degree was constructed from the observations. A striking feature brought out by this magnetic map was that all the isogonic lines had a sharp bend, the convex side of which pointed north-eastward towards New Hope and Lambertville, on the Delaware. The curves are so extremely at variance with the simple, nearly straight lines of earlier maps, that the observations upon which they were based were suspected of being incorrect; they have, however, now been beautifully confirmed by geology. The geological survey of the two counties, begun at the end of 1887, has now proved beyond question the existence of an enormous fault, of about 14,000 feet, in the rock beds, almost precisely on the line of the Delaware River end of the axis of the bend in the curves, and following the same course from there westwards. In other words, the axis of the bend in the magnetic curves lies directly above the line of fault determined by geological observations. The topography of the region shows no strongly-marked ridge following the course of the axis of the curves, neither does the form of the out-cropping rocks, sedimentary or igneous, correspond in any way with them; but there is no doubt that the remarkable magnetic peculiarity of the region is related to the equally remarkable and completely corresponding geological structure. This confirmation of one set of observations by another of a different character, and made quite independently, furnishes a striking instance of the connection between different branches of scientific investigation.

MR. W. F. LLOYD, in giving a brief description of experiments made by him to determine the specific heat of human blood, in the *British Medical Journal*, mentions that this physical property appears not to have been previously investigated in this country. The results obtained in his experiments give 0.710 as the specific heat of human blood. Having determined this value, the amount of heat required to raise the temperature of a certain quantity of blood can, of course, be easily calculated. Suppose that the temperature of a patient whose weight is 65 kilogrammes is 37° C., and twelve hours after this the temperature has gone up 3° C. The weight of the patient's blood would be $\frac{1}{3}$ of 65, or 5 kilogrammes, and the amount of heat required to raise the temperature of 5 kilogrammes 3° C. will be: $5000 \times 0.71 \times 3 = 10,650$ heat units, the mechanical equivalent of which is 4,515,600 grammetres. This amount of work represents the chemical energy which must be required to raise the temperature of the blood of the patient 3° C. in twelve hours, so that in every second the chemical changes going on are represented by the amount of energy required to lift 104.5 grammes 1 metre high against the force of gravity. From this

it will be seen that the amount of energy going on in the tissues of a patient whose temperature is rising must be very considerable, and about thirteen times greater than the above figures, for these figures apply only to the blood. Mr. Lloyd suggests that the difficult problem with regard to the number of atoms in the molecule of protoplasm, which has hitherto baffled physiologists, may be finally solved by an accurate determination of the specific heat of living protoplasm.

WE are sorry to learn that Mr. Alfred Allen, of Bath, finds it necessary to discontinue the *Journal of Microscopy and Natural Science*, which he has edited for the last sixteen years, in consequence of the circulation being slightly too small to cover the cost of publication. The last number is one of the best that we have seen, and contains articles by Dr. Jabez Hogg on "The so-called Jumping Bean of Mexico," by E. Steinhouse on "How Plants live and work," and a reprint of an important paper by Dr. August Forel, of Zürich, on "Ants' Nests." The Postal Microscopical Society, with which the *Journal* was semi-officially connected, will still be continued.

THE problems of the liquefaction of the more permanent gases has always aroused a considerable amount of scientific interest, and this has been especially the case with fluorine, in which there is the added difficulty of the extraordinary chemical activity of the gas. The successful issue of this problem was first announced by Profs. Moissan and Dewar in May last (see p. 126), and in the current number of the *Comptes rendus* of the Paris Academy of Sciences, there is a further contribution to this subject by the same authors. In the preliminary account, especial interest was excited by the description of a white explosive substance, apparently a compound of fluorine and oxygen; it is now shown, however, that liquid fluorine and liquid oxygen mix in all proportions if the oxygen is perfectly dry, and that it is the presence of moisture which determines the formation of the white explosive body, which would appear to be simply a hydrate of fluorine, decomposable with detonation by a slight rise of temperature. In the earlier experiments it was found that fluorine could not be liquefied by oxygen boiling under atmospheric pressure, but it is now shown that freshly prepared liquid air, boiling under the same conditions, can effect the liquefaction. The boiling point of fluorine is found to be -187°C ., and there is no sign of solidification nor even of loss of mobility at -210°C . The density of fluorine, as determined by the flotation of solids of known density, is 1.14, and the liquid is devoid both of magnetic action and of any absorptive effect upon the spectrum. The chemical reactions of the liquid are curious, as although at -210° there is no action upon water or mercury, it still combines violently with hydrogen and essence of turpentine. A little of the liquid fluorine, accidentally spilt, set fire to the wooden floor.

THE subtropical garden of Mr. Thos. Hanbury, at Palazzo Orengo, La Mortola, near Ventimiglia, is well known to all visitors to the Riviera. Mr. Hanbury has just issued an alphabetical catalogue of plants growing in the open air in the garden, compiled by K. Dinter. It occupies fifty-three quarto pages. The native country is given of each species.

THE current number of the *Journal* of the Royal Statistical Society contains the Howard Medal Prize Essay, by Dr. James Kerr, on "School Hygiene, in its Mental, Moral, and Physical Aspects." The subject for the medal to be awarded in 1898 (with 20% as heretofore) is "The Treatment of Habitual Offenders, with special reference to their Increase or Decrease in various Countries."

THE Physical Society of London meets on Friday, October 29, at the rooms of the Chemical Society. Prof. Stroud will exhibit and describe the Barr and Stroud naval range finder, and also a telemetrical focometer and spherometer; Mr. Ackermann will exhibit a surface-tension experiment.

AT the meeting of the Chemical Society on Thursday, November 4, the following papers will be read:—"The Properties of Liquid Fluorine," by Profs. Moissan and J. Dewar; "The Liquefaction of Air and the Detection of Impurities" and "The Absorption of Hydrogen by Palladium at High Temperatures and Pressures," by Prof. Dewar.

A NEW instalment of the second edition of Dr. W. Ostwald's "Lehrbuch der allgemeinen Chemie" has just been published by Engelmann of Leipzig. The first volume of the new edition was completed in 1891, and the first part of the second volume appeared in 1893. These portions of the work have already been reviewed in *NATURE* (vol. xlviii. p. 49, 1893). We announced nearly a year ago the publication of the first section of the second part of the second volume, dealing almost entirely with the history of chemical affinity, and now the second section has appeared. In this section chemical dynamics is treated under two heads—chemical kinetics and chemical statics. It is announced that the remaining parts of the work will be published in the course of next year, and we propose to defer our review until the work is completed. At the present time we will only say that chemists will be glad when the second volume is finished; for, to repeat the opinion already expressed in these columns, "its appearance will serve to complete a work which goes further than any other to show how chemistry and physics must be united in the endeavour to arrive at the real nature of material phenomena."

"THE Bibliography of X-Ray Literature and Research, 1896-1897," will be published in a few days by *The Electrician* Printing and Publishing Company. The book is edited by Mr. C. E. S. Phillips, who has also contributed an historical retrospect, and a chapter on "Practical Hints on Röntgen Ray-Work." The same Company will also issue at the end of October a new work by Messrs. Fisher and Darby, entitled "The Student's Manual to Submarine Cable-Testing." Mr. Young J. Pentland announces:—"Text-Book of Physiology, by British Physiologists," edited by Prof. E. A. Schäfer, F.R.S., two vols., illustrated; "Text-Book of Medicine, by British Teachers," edited by Dr. G. A. Gibson, illustrated; "Manual of Operative Surgery," by H. J. Waring, illustrated; "Manual of Diseases of Women," by Dr. J. Clarence Webster, illustrated; "Diseases of the Heart and Circulation," by Dr. G. A. Gibson, illustrated; "The Principles of Treatment," by Dr. J. Mitchell Bruce; "Diseases of the Kidneys," by Dr. Robert Maguire; "Manual of Midwifery," by Dr. R. Milne Murray, illustrated; "Examination of the Eye," by Simeon Snell, illustrated; "Edinburgh Hospital Reports," edited by Drs. G. A. Gibson, C. W. Cathcart, John Thomson, and D. Berry Hart, vol. v.; "Diabetes Mellitus: its Symptoms, Pathology, and Treatment," by Dr. R. T. Williamson.

A SHORT historical account of the Royal Society of Canada, and the work it has accomplished, is contributed to the *Canadian Magazine* by the honorary secretary, Dr. J. G. Bourinot, C.M.G. The Society was established on the initiative of the Marquis of Lorne, then Governor-General of Canada. The first meeting was held in May 1882, under the presidency of the distinguished geologist, Dr. (now Sir) J. W. Dawson. The membership to begin with amounted to eighty Fellows, who had written—to quote the constitution—"memoirs of merit or rendered eminent services to literature or science"; a number subsequently increased to a hundred, or twenty-five each to the four sections of (1) French Literature and History; (2) English Literature, History and Archæology; (3) Mathematical, Physical and Chemical Sciences; (4) Geological and Biological Sciences. From the very commencement the Canadian Royal Society has been composed of men who have devoted themselves with ability and industry to the pursuit of literature,

science and education in the Dominion. Thanks to the encouragement given by the Canadian Government, the Society has been able, year by year, to publish a large volume of the proceedings and transactions of its members. The papers and monographs therein contained embrace a wide field of literary effort—the whole range of archæological, ethnological, historical, geographical, biological, geological, mathematical and physical sciences; and they bear witness to fifteen years of creditable work for the intellectual welfare of the Dominion of Canada.

THE additions to the Zoological Society's Gardens during the past week include a White-collared Mangabey (*Cercocebus colaris*, ♀) from West Africa, presented by Miss Daisy Kendall; a Beisa Antelope (*Oryx beisa*), a Caffre Cat (*Felis caffra*) from Somaliland, two Arabian Gazelles (*Gazella arabica*, ♂♂) from Arabia, presented by Mr. J. Benet Stanford; a Zanzibar Antelope (*Nesotragus moschatus*, ♀), an Augur Buzzard (*Buteo augur*) from East Africa, presented by Mr. Cavendish; a Red River Hog (*Potamocheirus penicillatus*, ♀) from West Africa, presented by Captain Smith, s.s. *Boma*; a Leopard (*Felis pardus*, ♂) from West Africa, presented by Captain Huinfrey; a Chinchilla (*Chinchilla lanigera*) from Chili, presented by Mr. J. A. Wolffsohn; an Egyptian Ichneumon (*Herpestes ichneumon*) from Egypt, presented by Mr. Ernest A. Dixon; a Spotted River Turtle (*Emyda vittata*) from India, presented by Mr. A. Felix; a Geoffroy's Cat (*Felis geoffroyi*), a Matamora Terrapin (*Chelys fimbriata*) from Brazil, presented by Mr. W. Brice; a Spotted Eagle Owl (*Bubo maculosus*), a Delalande's Lizard (*Nucras delalandii*), three Lineated Snakes (*Brodia lineatus*), eleven Rough-keeled Snakes (*Dasyptellus scabra*), four Crossed Snakes (*Psammophis crucifer*), ten Rufescent Snakes (*Leptodira holambæia*), two Rhomb-marked Snakes (*Trimerorhinus rhombatus*) from Port Elizabeth, South Africa, presented by Mr. J. E. Matcham; a Wapiti Deer (*Cervus canadensis*, ♂), two Collared Fruit Bats (*Cynonycteris collaris*), born in the Gardens; a Great Wallaroo (*Macropus robustus*, ♀) from South Australia, purchased; a Cape Zorilla (*Ictonyx zorilla*) from South Africa, deposited.

OUR ASTRONOMICAL COLUMN.

THE LAW OF SPECTRAL SERIES.—Previously in this column (vol. iv. p. 137) we have referred to some of the work which has been done with the object of finding satisfactory formulæ for the computation of the wave-lengths of lines which form spectral series. Two further interesting communications have recently been published, which are important in that they suggest that the formulæ at present in use are only roughly approximate for the series as a whole, and that the anomalies which here and there are found may eventually be satisfactorily explained. The first of these communications is due to Prof. T. N. Thiele (*Astrophysical Journal* for August), who has for some time been occupied with investigations on the law of spectral series, and whose remarks are of considerable importance. The problem, as he states, is a very troublesome one, and those who occupy themselves with it cannot hope to make, so far as his experience goes, those little discoveries which relieve tedious investigations. In fact, one's fundamental assumptions often give way before the constant criticism to which they are exposed. The general law of series is, however, still wanting, although the more or less complete resolution of spectra into series may be now approximately accomplished. Prof. Thiele's work has proved that the law, which expresses the wave-lengths of the lines in a spectral series, must have the form

$$\lambda = f[(n + c)^2]$$

when λ is the wave-length, and c a constant which he calls the phase of the series: all other formulæ are only special cases of this general one. Accepting this formula and all its consequences some very interesting points arise, the most important being that it is necessary to take into account not only the lines

corresponding to positive values of n , but those when n is less than 0. This involves that a series must in general be composed of two groups of lines, each of which would ordinarily be called a series, or, as Prof. Thiele calls them, two branches, but cases may arise when the two branches coincide. It does not necessarily follow that both series will always be seen, as the intensity of one may be much less than that of the other. In cases where there are three, four, or more branches, the pairs of branches must be separated out. Another point which arises from this new idea is the question as to whether the double series, ordinarily found in metallic spectra, may not also be regarded as constituting a single series in which both the negative and positive values of n are used. In the same paper Prof. Thiele gives a modification of Prof. Pickering's formula for use in more precise investigations. As an illustration of the question of the relation between sharp and diffuse series as branches of a single series, Prof. Thiele works out the lines in the spectrum of helium, and he is led to the conclusion that "in spite of the remarkable correspondence of these two series I must therefore (*sic*) deny their unity." The second paper, which we can now only briefly refer to, is that by L. Rummel, read before the Royal Society of Victoria in 1896, November 12 (vol. ix.). The author practically obtained a formula independently but similar to that given by Balmer for computing the wave-lengths of the spectral lines of the alkalis, working out the substances lithium, sodium, potassium, rubidium, and cesium. In another paper, communicated by the author to the same Society in 1897, June 10 (vol. x.), he gives the result of his investigation on the relationship between the spectra of the alkalis and their atomic weights.

THE VARIABLE STAR η AQUILÆ.—In the *Memorie della Società degli Spettroscopisti Italiani*, Prof. A. Belopolsky describes some preliminary researches which he has made with respect to the motion of the variable star, η Aquilæ, as determined by movement in the line of sight. Up to the present time he has been able to secure twelve photographs, the duration of exposure in all cases being less than an hour. The measures were made relatively to the solar spectrum, which was superposed on the spectrum of the star with the help of the artificial spectrum of iron. Twelve prominent lines were used, and three systems of readings were obtained; namely, those given by comparing the stellar and solar spectrum, the solar and artificial spectrum, and the stellar and artificial spectrum. By means of a graphical process the author determines the required and the direct displacement.

The following summary gives in tabular form the times of observation, the intervals of time between the minimum and the moment of observation, the radial velocity, and the velocity relative to the sun.

1897.	Mean time Pulkova.	Interval from minimum.	Radial velocity.	Vel. rel. to $\odot$.
	h.	d. h.		
July 10	... 12	... 2 14	... -4'485	... -3'86
11	... 12	... 3 14	... -4'454	... -3'89
12	... 13	... 4 15	... -3'196	... -2'70
13	... 12	... 5 14	... -2'022	... -1'58
17	... 12	... 2 10	... -3'629	... -3'44
21	... 12	... 6 10	... -1'228	... -1'29
22	... 12	... 0 6	... +0'146	... +0'02
25	... 11	... 3 6	... -4'016	... -4'32
25	... 12	... 3 7	... -3'604	... -3'91
26	... 11	... 4 8	... -2'930	... -3'29
30	... 12	... 1 2	... +1'195	... +0'58
Aug. 2	... 11	... 4 1	... -2'856	... -3'65

Plotting the curve of velocities, after the method of Rambaut and Lehmann-Filhés, Prof. Belopolsky finds that the period 7d. 4h. is sufficiently satisfied on the supposition that the changes of the radial velocity are due to orbital movement of the star. A computation of the orbit, after the method described in *Astronomische Nachrichten* (No. 3242), leads the author to the conclusion that the variation of light cannot be attributed to an eclipse, as the time of eclipse ought to take place 2d. 0h. or 5d. 11h. after the minimum, which is not in accordance with the actual facts. This result is interesting in that it tends to corroborate the conclusion arrived at by Dr. W. J. S. Lockyer ("Resultate aus den Beobachtungen des veränderlichen Sternes η Aquilæ," 1897, Dulau and Co., London) in the latest